

Surveys
SPR 94

REPORT *of* FOREST INSECT SURVEYS IN OREGON AND WASHINGTON SEASON OF 1954



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and
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REPORT OF FOREST INSECT SURVEYS IN OREGON AND WASHINGTON

SEASON OF 1954

INTRODUCTION

In the past years insect outbreaks of catastrophic proportions have plagued the forests of Oregon and Washington. During the past six years the spruce budworm, Douglas-fir beetle, silver fir beetle, and the western pine beetle have been most destructive. To make matters worse, the balsam woolly aphid was found to be causing severe losses in silver fir in 1954. Although some improvement in the general forest insect situation in these two states was found in 1954, the task of preventing serious losses and depletion of forest resources remain acute. In 1954 epidemic infestations of forest insects were recorded on 7,704,120 acres, or approximately 16 percent of the forested area of Oregon and Washington.

Three cooperative forest insect surveys were conducted in Region 6 in 1954: First - the regular regional aerial and ground survey of the entire forested area recorded data on all major forest insect pests; second - a special survey of the silver fir beetle infestation in western Washington; and third - the aerial rephotography of 75 plots in the Douglas-fir region provided data on the status of the Douglas-fir beetle and the volume losses in the region.

The results of the first survey are summarized in the present report. PART I is a summary and review of the spruce budworm situation, including summaries of data (graph 1 and tables 1 and 2). PART II is a brief review of other major forest insect problems recorded in 1954. PART III contains an acknowledgement of the cooperation on the 1954 survey; summaries of the field data (tables 3-8); a list of spruce budworm reports and publications; and maps showing the status of the spruce budworm and five other major forest insects in 1954.

The results of the silver fir beetle survey and the Douglas-fir beetle plot photography have been summarized and reports issued.

PART I - SPRUCE BUDWORM PROBLEM

General Statement

Since 1944, an aggressive and widespread epidemic of the spruce budworm, Choristoneura fumiferana (Clem.), has persisted in the Douglas-fir and true fir forests of Oregon and Washington. To combat this menace, the Northwest Forest Pest Action Committee^{1/} has recommended a cooperative aerial spraying program, now in its seventh year (see appendix). During the period 1949-1954 inclusive, the spruce budworm has been successfully controlled in the more valuable stands and in the heaviest centers of infestation on 3,220,000 acres at a cost of about \$3,387,000 or about \$1.05 per acre. In spite of this effort, 1,034,440 acres of epidemic infestation remain.

The significant accomplishments of this control program (graph 1) have been:

1. The epidemic, which started in 1944 and reached a peak of 2,276,000 acres in 1949, has been reduced to 1,034,440 acres in 1954; of which, 686,020 acres are in the recognized protection zone and 348,420 acres in units where no control will be undertaken.

^{1/} The Northwest Forest Pest Action Committee is composed of numerous private individuals and representatives of the following organizations:

Associated Forest Industries of Oregon	Oregon Extension Service
Industrial Forestry Association	Oregon Forest Fire Association
Keep Oregon Green Association	Oregon State Board of Forestry
Keep Washington Green Association	Oregon State College
Southern Oregon Conservation and Tree Farm Association	
State College of Washington	
Tree Farm Management Service	
U. S. Bureau of Land Management	
U. S. Forest Service	
U. S. Office of Indian Affairs	
U. S. Soil Conservation Service	
University of Washington	
Washington Forest Fire Association	
Washington State Division of Forestry	
Washington State Forestry Conference	
Western Forest Industries Association	
Western Forestry and Conservation Association	
Western Pine Association.	

2. The acreage of heavy epidemic infestations, on which tree-killing was in progress, was reduced from 887,000 acres in 1949 to 82,000 acres in 1951. Since 1951 this acreage has increased to 245,760 acres with 33,360 acres in the units excluded from control.
3. General killing of old and young growth timber has been confined to less than 10,000 acres.
4. Epidemic infestations have been eliminated in the Western Oregon area and tree killing has been entirely prevented.
5. Epidemic infestations have been eliminated from the Eastern Oregon Cascade Area and tree killing has been kept to a low level.
6. Less than one percent of the 3,220,000 acres treated to date have had to be resprayed because of budworm reinfestations.
7. The recovery of defoliated trees following spraying operations has been remarkable and clearly proves the beneficial effects of the program.
8. Valuable watersheds have been protected and a potentially serious forest fire hazard has been largely averted.
9. The practicability of aerial spraying to control the spruce budworm at a reasonable cost per acre has been demonstrated.

The principal highlights of the six completed control projects are as follows:

<u>Year</u>	<u>Acreage Treated</u>	<u>Average Cost per Acre</u>	<u>Total Cost</u>	<u>Spruce Budworm Mortality Range</u>	<u>Average</u>
1949	266,000	\$1.20	\$320,400	88.9-100%	97%
1950	934,000	1.06	988,980	90.4-100%	99%
1951	927,000	1.06	982,620	74.0-100%	98%
1952	656,000	1.04	682,240	81.8-100%	98%
1953	369,000	.95	350,050	88.5-100%	99%
1954	68,000	.93	62,670	96.3-100%	99%
Total	3,220,000	\$1.05	\$3,386,960	74.0-100%	98%

Direct control through aerial application of DDT insecticide has been recommended and undertaken only as an emergency measure: (1) To prevent serious timber losses, (2) to prevent the reinfestation of units successfully treated, and (3) to protect until natural control becomes fully effective. Since 1950, there have been local indications that natural control was becoming increasingly effective. On the Wenatchee Unit the center of epidemic infestation, which had been present for several years, disappeared in 1954 from natural causes; however, on most unsprayed units these factors had not yet become significant enough to turn the epidemic downward.

The Spruce Budworm Situation in 1954

Spruce budworm conditions in 1954 in Forest Service Region 6 are presented in this section. A review of the progress of the budworm epidemic and control measures is presented in Graph 1 and a summary of 1954 infestations by intensities and broad ownership classes is given in tables 1 and 2, which follow.

Most of the 1954 budworm infestations were detected during aerial survey, using the same techniques as those past surveys. Ground surveys located additional centers of budworm infestation not detectable from the air which will bear careful watching during subsequent surveys. The aerial phase of the 1954 survey (table 3) started on July 12 and was completed on September 26.

The standards for evaluating the degree of spruce budworm epidemic infestations have remained the same since the start of aerial surveys, as follows:

- Light - Defoliation light, barely visible from the air; no tree killing expected for at least two years.
- Moderate - Defoliation moderate; no tree killing expected for at least one year.
- Heavy - Defoliation moderate to severe; some tree killing in progress, general tree killing probable next year.
- Very Heavy - Defoliation severe; general tree killing in progress.
- Dead - Defoliation complete; trees predominantly dead on extensive areas.

The spruce budworm situation in 1954, as compared with that of 1953 on the same areas, is as follows:

<u>Area</u>	<u>1953 Acres</u>	<u>1954 Acres</u>
Blue Mountains-Oregon	994,420	1,006,040
Blue Mountains-Washington	118,880	28,400
Eastern Washington Cascades	22,720	0
Western Washington	0	0
Eastern Oregon Cascades	0	0
Western Oregon	0	0
Area Totals	1,136,020	1,034,440
Total for Oregon	994,420	1,006,040
Total for Washington	141,600	28,400
State Totals	1,136,020	1,034,440

GRAPH I
PROGRESS OF SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON

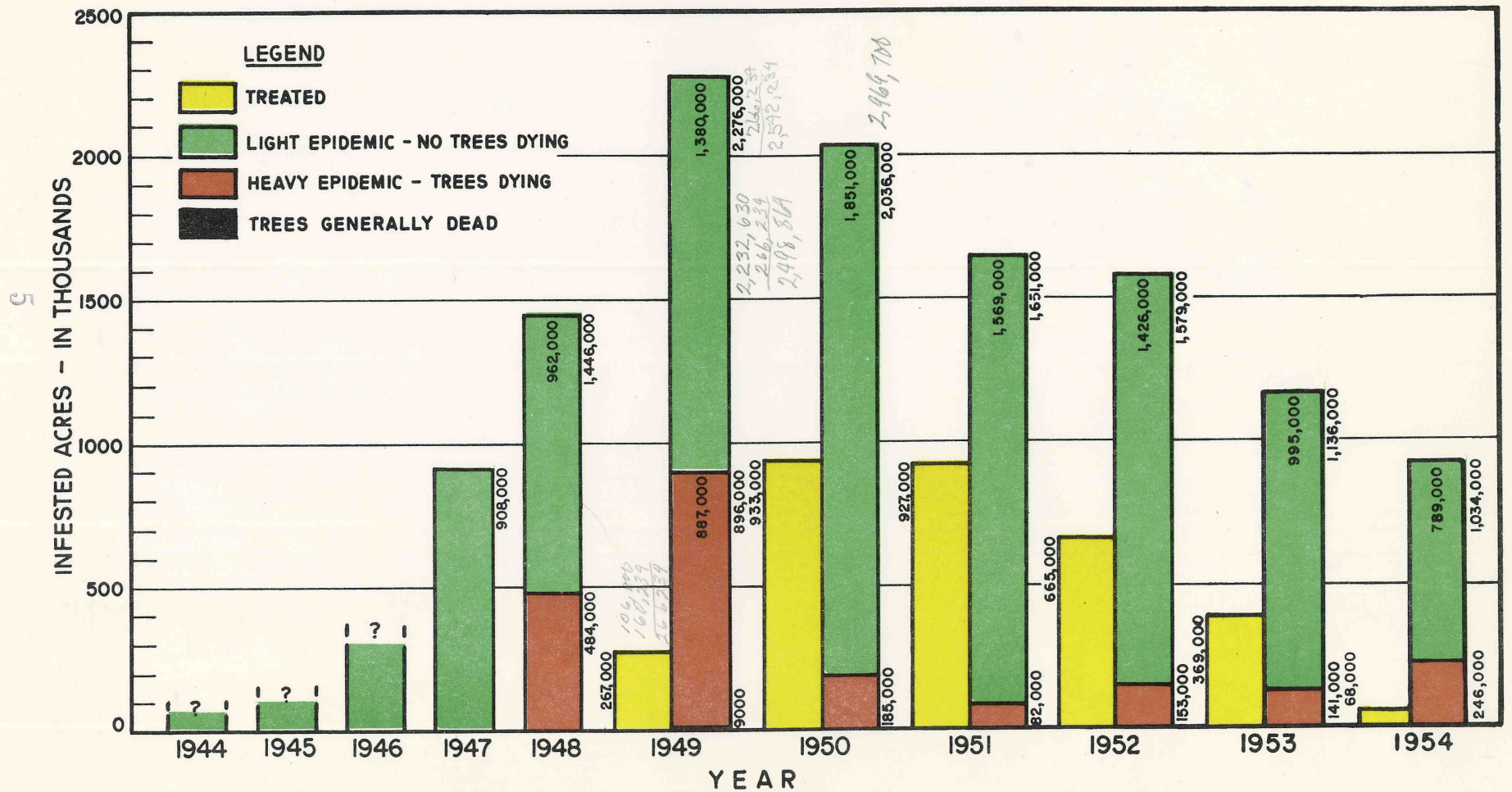


TABLE 1. SUMMARY OF 1954 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY INTENSITIES ^{1/}

AREA AND UNIT	INTENSITY OF INFESTATION									
	Light		Moderate		Heavy		Very Heavy		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS - OREGON										
(1) Ochoco	125,670	54.3	96,450	41.7	9,260	4.0			231,380	100
(2) Aldrich Mountain	12,190	74.9	4,080	25.1					16,270	100
(3) Malheur	33,810	15.7	55,170	25.4	104,680	48.2	23,300	10.7	216,960	100
(4) Susanville	12,500	88.4	1,240	8.8	400	2.8			14,140	100
(5) Silver Butte ^{2/}	5,320	36.6	9,230	63.4					14,550	100
(6) Powder River	10,970	19.1	8,190	14.3	38,200	66.6			57,360	100
(7) Baker Watershed	1,640	8.2	18,130	90.3	310	1.5			20,080	100
(8) Bald Ridge ^{3/}	2,500	100.0							2,500	100
(9) Catherine Creek ^{4/}	12,390	100.0							12,390	100
(10) Moss Spring	11,000	21.2	19,980	38.4	21,000	40.4			51,980	100
(11) Eagle Creek	21,430	44.3	12,030	24.9	14,430	29.8	520	1.0	48,410	100
(12) Joseph	49,230	46.4	34,940	32.9	14,200	13.4	7,720	7.3	106,090	100
(13) Snake	94,300	52.8	73,820	41.3	10,450	5.9			178,570	100
(14) Chesnimus	17,800	50.3	16,270	46.0	1,290	3.7			35,360	100
TOTAL FOR OREGON	410,750	40.9	349,530	34.7	214,220	21.3	31,540	3.1	1,006,040	100
BLUE MOUNTAINS-WASHINGTON										
(15) Saddle Mt.	25,200	88.7	3,200	11.3					28,400	100
TOTAL FOR WASHINGTON	25,200	88.7	3,200	11.3					28,400	100
GRAND TOTAL	435,950	42.2	352,730	34.1	214,220	20.7	31,540	3.0	1,034,440	100

- ^{1/} Does not include 67,717 acres treated during the 1954 control project
^{2/}, ^{3/} New centers of epidemic infestation since 1953 survey
^{4/} Portion of a unit treated in 1950 which has become reinfested

1,002,157

TABLE 2. SUMMARY OF 1954 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY OWNERSHIPS ^{1/}

AREA AND UNIT	OWNERSHIP CLASSES					
	Federal		State, Private and Other		Total	
	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS - OREGON						
(1) Ochoco	203,680	88.0	27,700	12.0	231,380	100
(2) Aldrich Mountain	14,670	90.2	1,600	9.8	16,270	100
(3) Malheur	153,160	70.6	63,800	29.4	216,960	100
(4) Susanville	10,720	75.8	3,420	24.2	14,140	100
(5) Silver Butte ^{2/}	14,550	100.0			14,550	100
(6) Powder River	42,110	73.4	15,250	26.6	57,360	100
(7) Baker Watershed	14,460	72.0	5,620	28.0	20,080	100
(8) Bald Ridge ^{3/}	1,700	68.0	800	32.0	2,500	100
(9) Catherine Creek ^{4/}	12,090	97.6	300	2.4	12,390	100
(10) Moss Spring	51,560	99.2	420	0.8	51,980	100
(11) Eagle Creek	44,910	92.8	3,500	7.2	48,410	100
(12) Joseph	92,620	87.3	13,470	12.7	106,090	100
(13) Snake	172,330	96.5	6,240	3.5	178,570	100
(14) Chesnimnus	34,560	97.7	800	2.3	35,360	100
TOTAL FOR OREGON	863,120	85.8	142,920	14.2	1,006,040	100
BLUE MOUNTAINS - WASHINGTON						
(15) Saddle Mt.	28,400	100.0			28,400	100
TOTAL FOR WASHINGTON	28,400	100.0			28,400	100
GRAND TOTAL	891,520	86.2	142,920	13.8	1,034,440	100

- ^{1/} Does not include 67,717 acres treated during the 1954 control project.
^{2/}, ^{3/} New centers of epidemic infestation since 1953 survey.
^{4/} Portion of a unit treated in 1950 which has become reinfested.

Although the acreage of epidemic infestations in 1954 is less than in 1953, the intensity of the infestation has materially increased, as shown below:

Intensity	1953		1954	
	Acres	Percent	Acres	Percent
Light epidemic infestations	537,080	47.3	435,950	42.2
Moderate epidemic infestations	457,990	40.3	352,730	34.1
Heavy epidemic infestations	140,950	12.4	214,220	20.7
Very heavy epidemic infestations	0	0	31,540	3.0
Total	1,136,020	100.0	1,034,440	100.0

The significant fact in the above comparison is the large acreage of heavy and very heavy epidemic infestations in 1954 in contrast with that of 1953. There are 104,810 more acres of infestation in these two categories than in 1953, with 31,540 acres in the very heavy class. This marks the first year since 1950 that very heavy budworm defoliation has been recorded. As yet, there are no new centers of dead timber as a direct result of budworm feeding; however, unless aerial spraying operations are conducted in 1955, present and future timber resource losses of a serious nature will undoubtedly occur in the Blue Mountains Area of Oregon. The vigor of both Douglas-fir and true firs on the unsprayed units has been greatly reduced as a result of repeated defoliations. The upper crowns of old and young growth have become "spike-topped". Stands of poles and samplings have been killed. Growth rates have been materially reduced and bark beetle outbreaks stimulated.

Throughout Region 6, there are extensive areas on which the budworm is present but undetectable from the air. To obtain information on these situations, as a precaution against the development of future budworm epidemics, cooperative ground sampling surveys have been conducted annually since 1949.

The 1954 spruce budworm ground survey plan followed that of 1953. Permanent sample plots, randomly selected from a large series of previously used temporary sampling points were established by cooperators in 1953 and were re-examined in 1954. A total of 486 plots (283 in Oregon and 203 in Washington) was the desired goal of this survey. In 1954 no organizational meetings were held to assign plots or discuss survey procedures as has been done in the past. Cooperators were contacted by letter and furnished forms and the locations of plots to be covered. At the end of the season 360 plots had been examined by 72 participants listed in tables 4 and 5. The budworm was found to be present on 31 plots (8.6%) and absent on 329 plots (91.4%).

Compared with 1953, the results of the 1954 budworm ground sampling survey were as follows:

	<u>1953</u>	<u>1954</u>
Number of counties sampled	37	40
Number of participating agencies	22	25
Number of cooperating foresters	90	72
Number of man-days	174	142
Number of plots - budworm present	39 { 9.6% }	31 { 8.6% }
Number of plots - budworm absent	369 { 90.4% }	329 { 91.4% }
Total number of plots examined	408	360

Although the survey plot coverage in 1954 was not quite as good as in 1953, the results show that the light spruce budworm populations, which are not detected from the air during the course of the aerial survey, have dropped slightly.

1954 Spruce Budworm Situation by Areas and Units

The current spruce budworm situation will be discussed by areas and numbered units listed in tables 1 and 2 and shown on map 1.

Western Oregon Area

It is gratifying to report that for the second consecutive year there are no centers of spruce budworm epidemic infestations in western Oregon. The sudden appearance and buildup of epidemic populations of the budworm in the high-value Douglas-fir stands in this area in 1948 was viewed with considerable concern and all centers of epidemic infestation, plus sizable buffer zones of light infestation, were treated in the years following detection. Thus, this pest has been kept from extensive spreading and tree killing has been entirely prevented in this vital timber producing area.

A summary of the detected infestations and control operations in the Western Oregon Area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1948	86,200 acres	1949	160,230 acres
1949	88,640 acres	1950	119,730 acres
1950	96,405 acres	1951	161,919 acres
1951	56,960 acres	1952	78,573 acres
1952	23,840 acres	1953	77,835 acres
1953	None	1954	None
1954	None		

160,230
106,126
24,230

During the 1954 ground survey in this Area, 194 plots were examined. The budworm was found to be present on 15 plots (7.7%) and absent on 179 plots (92.3%). Because of the timber values at stake, this Area will continue to receive special attention during subsequent surveys for any signs of spruce budworm activity.

Eastern Oregon Cascades Area

No epidemic infestations of the spruce budworm were found in the Eastern Oregon Cascades Area in 1954, marking the third consecutive year since 1948 that the budworm has been absent in this area. The trees on the treated units show excellent recovery from defoliation by the budworm. Serious timber losses have been prevented by the aerial spraying operations conducted from 1949 to 1952.

A review of the recorded infestations and control operations in this area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>	
1948	102,790 acres	1949	106,000 acres	106,000
1949	39,990 acres	1950	40,338 acres	39,990
1950	104,460 acres	1951	160,554 acres	145,000
1951	77,440 acres	1952	70,415 acres	
1952	None	1953	None	
1953	None	1954	None	
1954	None			

During the 1954 spruce budworm ground survey, 24 plots were re-examined. The budworm was found to be present on 2 plots (8.3%) and absent on 22 plots (91.7%).

Although no aerial spraying operations have been conducted in this area since 1952, the entire area is carefully observed during the regional survey to locate any signs of budworm populations that would again threaten the fir stands in the area as well as those in western Oregon.

Blue Mountains-Oregon Area

All of the acreage of spruce budworm epidemic infestations recorded in Oregon in 1954 was confined to this area (tables 1 and 2 and map 1). There has been both an increase in the extent of the infestation and a marked increase in the intensity of the infestation in this area in 1954 as compared to 1953. Two new centers of epidemic infestation were recorded in this area in 1954. A summary of the recorded infestations and control work in the area is as follows: ,

760
1180
310

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreages Treated (Includes Buffer Zones)</u>
1947	665,000 Acres		
1948	1,117,000 Acres		
1949	1,939,000 Acres	1950	747,781 Acres
1950	1,515,000 Acres	1951	479,164 Acres
1951	1,329,480 Acres	1952	371,511 Acres
1952	1,407,680 Acres	1953	291,336 Acres
1953	994,420 Acres	1954	67,717 Acres
1954	1,006,040 Acres		
		Total	1,957,509 Acres

The 1954 aerial spraying project was confined to the La Grande Control Unit in the Blue Mountains-Oregon Area with the following excellent results:

<u>Control Unit</u>	<u>Acreage Treated</u>	<u>Cost Per Acre</u>	<u>Range of Mortality</u>	<u>Average Mortality</u>
La Grande	67,717	\$0.93	96.3 - 100%	99.0%

No detailed spruce budworm ground sampling surveys have been conducted in this area since 1949 because the budworm is known to be present throughout the unsprayed portions of the area. Ground checks following the aerial survey have picked up light epidemic infestations of the budworm which were not as yet detectable from the air. These have been followed during subsequent aerial surveys to mark their increase or decrease.

The status of the spruce budworm in the Blue Mountains-Oregon Area in 1954 is discussed by the 14 numbered units recorded by the survey, as follows:

(1) Ochoco Unit - During the present spruce budworm epidemic on and adjacent to the Ochoco National Forest, the acreage and intensity of the infestation has been quite variable, as shown by the following comparison:

<u>Year of Survey</u>	<u>Light Acres</u>	<u>Intensity of Infestation</u>				<u>Total Acres</u>	<u>%</u>
		<u>%</u>	<u>Moderate Acres</u>	<u>%</u>	<u>Heavy Acres</u>		
1947	15,000	100.0				15,000	100
1948	0					0	
1949	13,840	100.0				13,840	100
1950	56,320	64.1	17,920	20.4	13,600	87,840	100
1951	65,120	75.9	20,640	24.1		85,760	100
1952	107,840	39.5	165,440	60.5		273,280	100
1953	176,600	93.5	12,250	6.5		188,850	100
1954	125,670	54.3	96,450	41.7	9,260	231,380	100

The ownerships in the 1954 infestation show 203,680 acres (88.0%) federal and 27,700 acres (12.0%) private.

Repeated defoliations by the budworm during the past several years have begun to have serious affects on the firs in this unit. Top-killing and serious weakening of old and young growth trees and killing of stands of saplings and seedlings is in progress throughout the unit. Because of the fluctuating nature of this infestation, it was hoped that it would subside from natural causes. However, the situation has become more acute and control operations in 1955 are necessary for the following reasons: (1) Extensive killing of old and young growth over large portions of the unit is imminent within one year, (2) large stands of saplings and seedlings are already dead and other stands are almost dead, (3) the threat of bark beetles in budworm-weakened trees makes spraying more urgent than heretofore. Egg counts in the fall of 1954, indicate an even larger budworm population in 1955. This unit should be treated in its entirety in 1955.

(2) Aldrich Mountain Unit - Spruce budworm infestation on this unit of the Malheur National Forest has steadily increased since it was first detected in 1952, as shown by the following comparison:

Year of Survey	Intensity of Infestation				Total	
	Light		Moderate			
	Acres	%	Acres	%	Acres	%
1952	5,120	100.0			5,120	100
1953	8,710	100.0			8,710	100
1954	12,190	74.9	4,080	25.1	16,270	100

The ownership in the 1954 infestation is 14,670 acres (90.2%) federal and 1,600 acres (9.8%) private.

Although the infestation in 1954 is almost 50 percent larger than in 1953, control is not recommended in 1955 for the following reasons: (1) The infestation is still mostly of light intensity, (2) tree killing by the budworm is not imminent, and (3) bark beetle activity in the fir stands is insignificant.

(3) Malheur Unit - The epidemic of the spruce budworm on the Long Creek Ranger District of the Malheur National Forest was first reported in 1947. It has grown progressively worse since 1951, as shown by the following comparison:

Year of Survey	Light		Intensity of Infestation				Very Heavy		Total	
	Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%	Acres	%
1947	41,000	100.0							41,000	100
1948	33,600	60.0	22,400	40.0					56,000	100
1949			127,900	100.0					127,900	100
1950	30,500	19.3	123,420	77.9	4,480	2.8			158,400	100
1951	117,400	82.4	24,960	17.6					142,400	100
1952	37,920	19.0	116,320	58.2	45,600	22.8			199,840	100
1953	71,850	37.5	70,230	36.7	49,400	25.8			191,520	100
1954	33,810	15.7	55,170	25.4	104,680	48.2	23,300	10.7	216,960	100

The ownerships in the 1954 show 153,160 acres (70.6%) federal, 63,590 acres (29.3%) private and 210 acres (0.1%) state.

The Malheur Unit was recommended by the Northwest Forest Pest Action Committee for treatment in 1953 and again in 1954. Due to a shortage in federal funds, the urgently needed control measures have been twice postponed. The conditions justifying control in the past remain valid and are even more acute in 1954. At the present time, 59.0 percent of the infestation is in the heavy and very heavy classes, while only 25.8 percent of the infestation in 1953 was classed as heavy, with no very heavy infestation.

Killing of old and young growth timber is in progress and whole stands of seedlings and saplings are already dead. Budworm egg counts, made in the fall of 1954, show that an increased population will be present on this unit in 1955. It is imperative that control of this infestation be undertaken in 1955.

(4) Susanville Unit - The Susanville Unit is, in reality, a part of the Malheur Unit. A summary of budworm epidemic infestations on this unit is as follows:

Year of Survey	Light		Intensity of Infestation				Total	
	Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%
1951	18,880	100.0					18,880	100
1952	21,600	87.1	3,200	12.9			24,800	100
1953	13,700	100.0					13,700	100
1954	12,500	88.4	1,240	8.8	400	2.8	14,140	100

The ownership in 1954 was 10,720 acres (75.8%) federal and 3,420 acres (24.2%) private.

Control of this infestation is now justified for the following reasons:

(1) The infestation has increased in severity, and (2) the unit is immediately adjacent to the Malheur Unit and treatment is necessary to block out the controlled stands and prevent reinfestation.

(5) Silver Butte Unit - A new center of spruce budworm epidemic infestation in the North Fork John Day River drainage around Silver Butte on the Umatilla National Forest was reported by the Supervisor and recorded during the 1954 survey. The ownership is entirely federal and the infestation is classified as follows:

Year of Survey	Intensity of Infestation				Total Acres %	
	Light Acres	%	Moderate Acres	%		
1954	5,320	36.6	9,230	63.4	14,550	100

The unit is immediately adjacent to the 1953 Dale Control Unit and threatens to reinfest portions of that unit. Although this is a new center of infestation and tree killing by the budworm is not imminent, it will be carefully checked in 1955 to determine its status.

(6) Powder River Unit - Defoliation by the spruce budworm on the Powder River Unit of the Whitman National Forest was extremely heavy in 1954 and the bulk of the fir timber on the unit is in a serious condition. Budworm egg counts in 1954, show that an increased population can be expected on this unit in 1955. A summary of the epidemic on this unit is as follows:

Year of Survey	Intensity of Infestation						Total Acres %	
	Light Acres	%	Moderate Acres	%	Heavy Acres	%		
1951	6,080	100.0					6,080	100
1952	480	1.5	30,720	98.5			31,200	100
1953	33,950	81.2	7,870	18.8			41,820	100
1954	10,970	19.1	8,190	14.3	38,200	66.6	57,360	100

The ownership in 1954 was 42,110 acres (73.4%) federal and 15,250 acres (26.6%) private.

This unit is separated from the 1954 La Grande Unit by only a high timbered ridge. With two-thirds of the unit supporting heavy infestation and killing of the old and young growth timber in progress, the Powder River Unit and the adjoining Baker Watershed Unit to the south should be treated in 1955. This will make one contiguous block of treated timber and prevent almost certain reinfestation of the La Grande Unit.

(7) Baker Watershed Unit - This unit is an extension of the Powder River Unit, separated for administrative reasons because it is the drainage supplying Baker, Oregon with it's municipal water supply. A summary of the budworm epidemic infestations in this unit is as follows:

Year of Survey	Intensity of Infestation						Total	
	Light Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%
1953	16,130	82.3	3,460	17.7			19,590	100
1954	1,640	8.2	18,130	90.3	310	1.5	20,080	100

The ownership in 1954 was 14,460 acres (72.0%) federal, 5,200 acres (25.9%) private, and 420 acres (2.1%) state and county.

The budworm infestation in this watershed developed rather quickly to epidemic proportions. It became more intense in 1954 and should be treated in 1955 to block out the control in these contiguous stands and to reduce the fire hazard which is rapidly developing in this important watershed.

(8) Bald Ridge Unit - A new center of light epidemic infestation totalling 2,500 acres was recorded in 1954 around Bald Ridge, south of Baker, Oregon on the Whitman National Forest. The ownership was 1,700 acres (68.0%) federal and 800 acres (32.0%) private. While it would be desirable to treat this infestation while it is of small size, control in 1955 is not recommended.

(9) Catherine Creek Unit - In 1950, the budworm epidemic infestations in the Catherine Creek drainage on the Whitman National Forest were treated as part of the La Grande Control Unit. The 1954 survey detected a light reinfestation in portions of Catherine Creek drainage totalling 12,390 acres. The ownership was 12,090 acres (97.6%) federal and 300 acres (2.4%) private. This unit is recommended for treatment in 1955 while it is of small size and to prevent further reinfestation of units brought under control.

(10) Moss Spring Unit - This unit comprises the upper portion of the Minam River drainage on the Whitman National Forest. Epidemic infestations of the budworm on the lower Minam River were sprayed in 1952 but the infestations, now designated as the Moss Spring Unit, were not treated. A summary of the situation in this unit is as follows:

Year of Survey	Intensity of Infestation						Total	
	Light Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%
1952			26,880	100.0			26,880	100
1953	8,330	34.7	13,000	54.1	2,690	11.2	24,020	100
1954	11,000	21.2	19,980	38.4	21,000	40.4	51,980	100

The ownership in 1954 was 51,560 acres (99.2%) federal and 420 acres (0.8%) private, state and county.

Although this infestation has increased in size and intensity, control is not recommended in 1955 because of low commercial timber values. The unit is separated from the Catherine Creek and Eagle Creek Units by the summit of the Wallowa Mountains. There is a possibility of reinfestation of the adjoining treated units; however, control at the present time does not seem justified.

(11) Eagle Creek Unit - Spruce budworm epidemic infestations have been present in the Eagle Creek drainage of the Whitman National Forest since 1949. They have grown steadily worse since 1951, as shown by the following comparison:

Year of Survey	Light		Intensity of Infestation				Very Heavy		Total	
	Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%	Acres	%
1951	24,960	100.0							24,960	100
1952	12,960	27.9	32,000	69.0	1,440	3.1			46,400	100
1953	18,440	39.7	21,570	46.5	6,400	13.8			46,410	100
1954	21,430	44.3	12,030	24.9	14,430	29.8	520	1.0	48,410	100

The ownership in 1954 was 44,910 acres (92.8%) federal, 3,460 acres (7.1%) private, and 40 acres (0.1%) state and county.

Control of this infestation is now urgently needed. The timber values are high in West Eagle Creek but generally low in East Eagle Creek, while the recreational values are quite high on the entire unit. The epidemic has increased in severity and the affected stands are in poor vigor as a result of repeated defoliations. Egg counts in the fall of 1954 show that an increased budworm population can be expected on this unit in 1955. To prevent serious timber losses, the unit should be sprayed in 1955.

(12) Joseph Unit - The spruce budworm was detected in this unit in 1947. The epidemic has increased in size and severity, especially since 1951, as shown by the following comparisons:

Year of Survey	Light		Intensity of Infestation				Very Heavy		Total	
	Acres	%	Moderate Acres	%	Heavy Acres	%	Acres	%	Acres	%
1951	106,240	100.0							106,240	100
1952	10,080	8.8	99,360	86.5	5,440	4.7			114,880	100
1953	48,050	35.9	53,880	40.3	31,830	23.8			133,760	100
1954	49,230	46.4	34,940	32.9	14,200	13.4	7,720	7.3	106,090	100

The ownership in 1954 was 92,620 acres (87.3%) federal, and 13,470 acres (12.7%) private, state, and county.

In spite of the duration of this infestation, tree-killing by the budworm was not significant until recent years. It is now becoming more prevalent. Control has not been considered on this unit because of the generally low commercial timber values and the relatively isolated nature of the unit. No control is recommended in 1955 for the same reasons.

(13) Snake Unit - The spruce budworm made its appearance in this unit on the Wallowa-Whitman National Forest in 1948. A comparison of the infestations since 1951 shows the following trends:

Year of Survey	Intensity of Infestation							
	Light		Moderate		Heavy		Total	
			Acres	%	Acres	%		
Acres	%	Acres	%	Acres	%	Acres	%	
1951	133,120	72.7	49,920	27.3			183,040	100
1952	12,160	6.3	159,200	82.9	20,640	10.8	192,000	100
1953	63,800	40.3	81,760	51.7	12,570	8.0	158,130	100
1954	94,300	52.8	73,820	41.3	10,450	5.9	178,570	100

The ownership in 1954 was 172,330 acres (96.5%) federal, and 6,240 acres (3.5%) private, state and county.

Although tree-killing by the budworm is increasing in the canyons, the generally low commercial timber values and the isolated position of the unit have ruled out control operations. Control in 1955 would not be justified for the same reasons.

(14) Chesnimus Unit - An epidemic of the spruce budworm has persisted on this isolated unit in the northeastern portion of the Wallowa-Whitman National Forest since 1947. The status of the infestation since 1951 is shown by the following comparison:

Year of Survey	Intensity of Infestation									
	Light		Moderate				Heavy		Total	
	Acres	%	Acres	%	Acres	%	Acres	%		
1951	50,560	58.4	27,680	32.0	8,320	9.6	86,560	100		
1952			60,320	64.8	32,800	35.2	93,120	100		
1953	17,060	18.5	58,690	63.7	16,350	17.8	92,100	100		
1954	17,800	50.3	16,270	46.0	1,290	3.7	35,360	100		

The ownership in 1954 was 34,560 acres (97.7%) federal, and 800 acres (2.3%) private, state and county.

The generally low commercial timber values in this unit have ruled against control measures even though tree killing by the budworm was occurring. Control of this epidemic in 1955 would not be justified for the same reason.

Blue Mountains - Washington Area

Control of the spruce budworm in the fir stands of the Blue Mountains - Washington Area has been on a priority basis, with first consideration given to control units where tree killing by the budworm was in progress or likely to occur within one year. The first sparying operations in this area were in 1950 and good progress was being made in controlling the budworm. However, by 1953, an aggressive and widespread epidemic of bark beetles in both Douglas-fir and true firs, weakened by repeated budworm defoliations, had become so severe that further aerial spraying operations could not be justified. Until the bark beetle epidemic subsides, further control of the budworm would not be justified in this area.

A summary of the budworm infestations and control operations undertaken in this area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1947	45,000 Acres		
1948	126,000 Acres		
1949	165,000 Acres	1950	25,853 Acres
1950	295,000 Acres	1951	115,672 Acres
1951	182,880 Acres	1952	134,612 Acres
1952	127,200 Acres	1953	None
1953	118,880 Acres	1954	None
1954	28,400 Acres		
		Total	<u>276,137 Acres</u>

The 1954 survey recorded spruce budworm infestations on only one unit in the Blue Mountains - Washington Area. No systematic ground sampling of budworm populations was undertaken in 1954 in this area.

(15) Saddle Mountain Unit - The spruce budworm has been present in this unit on the Pomeroy Ranger District of the Umatilla National Forest since 1948 but little tree killing has taken place. A review of the acreage and severity of infestations since 1951 shows the following trends:

Year of Survey	Intensity of Infestation						Total Acres %	
	Light Acres	%	Moderate Acres	%	Heavy Acres	%		
1951	31,040	59.3	21,280	40.7			52,320	100
1952	6,880	5.8	99,520	83.7	12,480	10.5	118,880	100
1953	6,880	5.8	99,520	83.7	12,480	10.5	118,880	100
1954	25,200	88.7	3,200	11.3			28,400	100

The ownership in 1954 was entirely federal.

In 1954, infestations of the budworm were less severe but the activity of bark beetles continued at a high level. Further control of the budworm is unwarranted until the bark beetle situation improves. The budworm is still a threat to the adjoining treated stands in the area but most of them are already heavily infested by bark beetles.

Eastern Washington Cascades Area

From the records at hand, it is evident that the spruce budworm in the Eastern Washington Cascades Area behaves differently than in other areas of the region. Moderate epidemic infestations were recorded in Chelan and Okanogan Counties between 1943 and 1950; however, these subsided from natural causes without appreciable loss of commercial timber. In 1950 a potentially serious epidemic developed in the Icicle Creek drainage on the Wenatchee National Forest and was brought under control in 1951. Due to the extremely hazardous spraying conditions on and adjacent to this unit, further operations in adjoining infested stands in Ingall and Nigger Creek drainages were not considered practical. Although this outbreak has persisted since 1951, little tree killing by the budworm has taken place. In 1954, no epidemic centers of infestation were recorded during the survey. Reports from the Supervisor of the Wenatchee National Forest substantiate this finding and show that the amount of infestation is not as heavy as in past years and that no control is necessary. A summary of budworm epidemics since 1947 and the control work in this area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zone)</u>
1947	197,600 Acres		
1948	(no survey)		
1949	(Surveyed - no infestation)		
1950	25,440 Acres	1951	9,420 Acres
1951	3,840 Acres	1952	None
1952	19,840 Acres	1953	None
1953	22,720 Acres	1954	None
1954	None		
		Total	9,420 Acres

Ground sampling surveys, to follow light infestations of the spruce budworm not detectable from the air in this area have not been extensive. During 1954, some 20 sample plots in Yakima and Klickitat Counties were established and examined. The budworm was found to be present on 11 plots (55.0%) and absent on 9 plots (45.0%)

Western Washington Area

It is gratifying to report that during the course of the present spruce budworm epidemic in Region 6, there have been no outbreaks of this pest reported or detected in the Western Washington Area. However, the budworm is known to be present in extremely light populations which cannot be detected during the course of the aerial surveys. Cooperative ground sampling surveys have followed the trend of these light infestations since 1949. In 1954, there were 122 plots examined by cooperators. The budworm was present on only 3 plots (2.5%) and absent on 119 plots (97.5%). Thus, it appears that natural control factors are keeping the budworm populations in this area well in check.

Discussion and Recommendations

Three facts are evident from the preceding discussion of the spruce budworm situation in Region 6 in 1954: (1) The acreage of epidemic infestations totals 1,034,440 acres - the lowest since 1947; (2) the infestation in portions of the Blue Mountains Area has become more severe, with 245,760 acres of heavy and very heavy infestations - the most since 1949; and (3) there is an urgent need for a continuation of the aerial spraying program in 1955.

During the six-year period, 1949-1954 inclusive, the Northwest Forest Pest Action Committee has recommended an aerial spraying program to control this serious pest in the fir stands of Oregon and Washington. A total of 3,220,000 acres have been successfully treated at a cost of about \$1.05 per acre. Less than one percent of this acreage has had to be resprayed because of reinfestation by the budworm. The high degree of recovery of the defoliated trees following spraying has been remarkable and clearly proves the beneficial effects of the program. Potentially serious epidemic outbreaks in western Oregon and in the eastern Oregon Cascades have been entirely eliminated. On extensive areas in the Blue Mountains and on a small area in eastern Washington, the budworm epidemic has been greatly reduced.

Since 1952, the spruce budworm problem in the Blue Mountains Area has been complicated by an aggressive outbreak of bark beetles, particularly the Douglas-fir beetle. Tremendous populations of this beetle have developed in budworm-weakened trees on both the sprayed and unsprayed units. On some of these units, budworm control by aerial spraying is impractical until the bark beetle epidemic subsides. On other units, budworm control is justified and must be undertaken if serious tree mortality by the budworm is to be averted.

The 15 units of spruce budworm epidemic infestations, recorded by the 1954 survey can be divided into 3 groups for consideration of control in 1955, as follows:

(1) Control operations in 1955 are fully justified on seven units - Ochoco, Malheur, Susanville, Powder River, Baker Watershed, Catherine Creek, and Eagle Creek - if serious timber losses are to be prevented.

(2) Control operations are not warranted in 1955 on four units - Aldrich Mountain, Silver Butte, Bald Ridge, and Moss Spring - but serious consideration should be given to treating these units in 1956.

(3) Control operations on the four remaining units - Joseph, Snake, Chesnimus, and Saddle Mountain - are not justified because of low commercial timber values and these units can be eliminated from present and future control plans.

PART II - OTHER MAJOR FOREST PEST PROBLEMS

All epidemic outbreaks of tree killing insects are recorded during the annual regional surveys in Oregon and Washington. Outbreaks recorded in 1954, other than for the spruce budworm, are discussed in Part II. The sections are numbered to agree with table 6 which summarizes for the region the number of centers and acreages of all epidemic infestation by insects. Tables 7 and 8 list by areas all current insect outbreaks, including the budworm. The areas infested by five of the more important insects, other than the budworm, are shown on map 2.

During the 1954 survey, data were also taken on damage caused by bears in western portions of the region, and damage to western hemlock from unknown causes in western Washington. These two kinds of damage are discussed in Part II.

If additional information is desired on a particular insect or the location of the damage as observed during the 1954 survey, requests should be sent to the Director of the Station.

1. Douglas-Fir Beetle (*Dendroctonus pseudotsugae*)

The 1954 survey revealed epidemic infestation by the Douglas-fir beetle on 5,071,750 acres, which was more than for any other insect (See table 6 and map 2). Since few trees of the current year's attack can be detected at the time of the aerial survey, the recorded tree kill always lags one year behind the current infestation. Thus the above figure is for the 1953 kill. Figures for the 1954 kill will not be available until the survey of 1955. A comparison of the 1953 and 1954 survey findings by subregions and states follows.

	1953 SURVEY	1954 SURVEY
	<u>Acreage</u>	<u>Acreage</u>
Eastern Washington	254,400	274,400
Western Washington	424,500	356,810
Total for Washington	678,900	631,210
Eastern Oregon	600,400	468,690
Western Oregon	3,553,500	3,971,850
Total for Oregon	4,153,900	4,440,540
GRAND TOTAL	4,832,800	5,071,750

The intensity of infestation decreased considerably in most of western Oregon and western Washington. The principal exceptions were the Smith River area in the Coast Range of Oregon and the Clackamas River and Middle Fork of the Willamette River areas in the Oregon Cascades where infestation continued at a high level. The apparent increase of infested acreage for western Oregon in the above table was due to an underestimate of the infested acreage on the unsurveyed part of the region in 1953. The actual figures for 1953 were much greater than indicated in the table.

The most severe infestation in eastern Oregon and eastern Washington again are in the Blue Mountains where the Douglas-fir beetle continues to kill large numbers of trees weakened by the spruce budworm. In some drainages in the northern part of the Umatilla National Forest little Douglas-fir timber of sawlog size remains alive. Considerable tree killing also occurred on the Mount Hood National Forest in Oregon and the Snoqualmie and Wenatchee National Forests and the Colville Indian Reservation in Washington.

Ground checks in western Oregon and western Washington indicated that the Douglas-fir beetle attacks in 1954 were strongly down. Infestation in the Cascades appears virtually over, with the possible exception of the upper Clackamas River drainage. The Oregon coastal area from the Alsea River to the Coos River continues to show epidemic activity, but even there the trend is definitely down. These are preliminary indications only, subject to verification in the 1955 survey.

Mortality figures for the Douglas-fir region have been brought up to date. Total kill by the Douglas-fir beetle and blowdown from 1950 to 1954 is estimated at about 15,000 MM board feet. Actual survey figures showed 3,072 MM killed by the Douglas-fir beetle from 1951 through 1953 and 10,394 MM board feet of blowdown from 1950 through 1953. Salvage is nearing its anticipated peak, but is expected to continue many years at a high rate. No direct control is in progress or planned.

2. Silver fir Beetles (Pseudohylesinus)

Epidemic infestations of silver fir beetles in Pacific silver fir are in the same general areas as in 1953. The northern Washington Cascades continue to be the area of heaviest damage. In the Olympic area the damage is continuing but on a much smaller acreage than recorded in 1953. In the southern Washington Cascades the silver fir is being attacked both by the beetles and by the balsam woolly aphid resulting in heavy kill. Relatively minor damage is continuing in other areas, principally northwestern Oregon. The trend of the over-all silver fir beetle problem is shown in the following table:

<u>Year of Survey</u>	<u>Epidemic Acreage</u>
1949	38,000
1950	55,000
1951	243,000
1952	(survey incomplete)
1953	543,843 (revised estimate)
1954	652,230

The above table shows an increase in the total area recorded in 1954 of 108,387 acres or 17 percent. The intensity of the infestation has increased to an even greater extent. The following table shows a comparison of the intensity of the infestation recorded in 1953 and 1954.

<u>Intensity of the Infestation</u>					
<u>Year of Survey</u>	<u>Total Acres</u>	<u>Light %</u>	<u>Moderate %</u>	<u>Heavy %</u>	<u>Very Heavy %</u>
1953	543,843	53	30	12	5
1954	652,230	28	47	19	6

The damage in the northern Washington Cascades is increasingly critical. For example, on the Baker River and Deer Creek areas, many stands which were lightly or moderately infested in 1953 are now heavily infested. Areas with new infestations are the upper Skagit River, Suiattle River, Pilchuck River, Sauk River, Whitechuck River, Skykomish River, and the Snoqualmie River.

The silver fir beetle situation on the Olympic area showed a marked decline in both total acres infested and the intensity of the infestation. A good deal of this apparent decline resulted from an over estimate in 1953. The 1954 survey recorded several relatively small centers of light to moderate damage in the major drainages on the west and southwest slopes of the Olympic Mountains.

In the southern Washington Cascades the silver fir beetle infestation is on the increase with the area of greatest activity centered around Mt. St. Helens. Both the acreage infested and the intensity of the damage have increased. Many of these infested areas are being attacked by both the silver fir beetle and the balsam woolly aphid.

A special survey in 1954 made by the Silver Fir Beetle Subcommittee of the Northwest Pest Action Committee showed a total silver fir volume of 6,949 MM board feet on the outbreak area of 1953. Of the total volume, 528 MM board feet was recently dead, 1,332 MM was high risk, and the remainder was low risk. A total of 448 plots was established to follow the trend of the outbreak.

Salvage on the most severely affected areas is being pushed. The Silver Fir Beetle Committee estimated that 147 MM board feet of silver fir was logged in 1954 primarily because of the beetles and that 205 MM board feet will be logged in 1955. No direct control is practical at present.

3. Western Pine Beetle (*Dendroctonus brevicomis*)

The extent and intensity of infestation by the western pine beetle are sharply down from the peak of 1953, as shown in the following table:

<u>Year of Survey</u>	<u>Year of Kill</u>	<u>Epidemic Acreage</u>
1951	1950	303,000
1952	1951	673,800
1953	1952	1,001,100
1954	1953	267,970

Hot spots remain on the Deschutes National Forest and the Yakima Indian Reservation, but even on those areas conditions are much improved.

During the winter of 1953-54 the principal control effort was on the Deschutes National Forest. There the largest center of infestation was cruised and most infested trees logged. The remaining outbreak on the Deschutes is in a young stand where the pine beetle is killing considerable groups of trees weakened by competition. Although the timber is of low value, plans call for control through salvage this winter. Plans also call for a sanitation-salvage cut on the most heavily infested areas on the Yakima Indian Reservation. Elsewhere in the pine region normal harvesting with attention to removal of high risk trees is steadily reducing the pine beetle hazard.

4. Mountain Pine Beetle (*Dendroctonus monticolae*)

Epidemic infestation declined from 331 centers covering some 322,400 acres in 1953 to 206 centers on 207,120 acres in 1954. This damage was recorded in lodgepole pine, western white pine and ponderosa pine in Oregon and Washington. The extensive outbreak which has been in progress for a number of years on the Chiwawa River, Wenatchee National Forest continues. Centers of heavy killing have shifted to the valley floor. A measure of relief is in sight as a logging road is being projected into the area and susceptible material of merchantable size will be removed along with the harvest of other tree species. Logging has also reduced the epidemic which has been in progress for some time in second growth stands of ponderosa pine on the Wallowa - Whitman National Forest near Baker, Oregon. The large center around Wanoga Butte on the Deschutes National Forest has been a threat to extensive lodgepole pine stands in Deschutes and Klamath counties for the past several years. This threat continues. Host material within the infestation boundaries is rapidly becoming exhausted and the mountain pine beetle may migrate out of the area in search of food.

Every year the mountain pine beetle is aggressively epidemic somewhere in the region, particularly in lodgepole pine and western white pine stands in the Cascade Range. The beetle moves about attacking and killing stands as they become of susceptible age. Often the attacked trees are too small or too remote to warrant either salvage or direct control. Only in the National Parks is there any concerted effort to control this insect. Elsewhere outbreaks are left to run their course if the infested stands cannot be utilized economically.

5. Fir Engraver Beetles (*Scolytus*)

Scolytus epidemics in true firs declined from 118,100 acres in 1953 to 56,200 acres in 1954. Most of the infestation is in inaccessible locations along the crest of the Cascades. The infested timber is largely of non-commercial quality.

6. Pine Engraver Beetles (*Ips*)

Ips killing of young ponderosa pine in epidemic amounts was recorded on 39,850 acres in 1954 as compared with 75,700 acres in 1953. The present situation is well below normal for the region. No control is needed.

7. Engelmann Spruce Beetle (*Dendroctonus engelmanni*)

Epidemic infestation by the Engelmann spruce beetle increased from 7,500 acres in 1953 to 18,720 acres in 1954. The greatest increase was on the Tieton District of the Snoqualmie National Forest, especially on Pinegrass Ridge where heavy killing has been in progress since 1952. The center in the excellent stands on the American River also is expanding rapidly.

Plans are being made to salvage the dead and threatened spruce on Pinegrass Ridge. A total of about 30 million board feet of all species will be cut, of which about half will be Engelmann spruce. Logging of infested and threatened Engelmann spruce on the Tollgate area of the Umatilla National Forest is in progress. Most of the other infested stands are remote and of too low value to permit salvage. In general the stands of Engelmann spruce in Oregon and Washington are few and too scattered to warrant direct control.

8. Spruce Budworm (*Choristoneura fumiferana*)

The Northwest Forest Pest Action Committee has analyzed the budworm situation and has prepared a control plan ^{2/} calling for the spraying of 600,720 acres in 1955. With the exception of about 85,000 acres on which control may be necessary in a year or two, and barring future spread, the proposed project should effect practically complete control within the stands being protected against the budworm. Some 350,000 acres of infestation in isolated, low value stands will not be treated.

For a detailed discussion of the spruce budworm see Part I.

9. & 10. Balsam Woolly Aphid (*Chermes piceae*)

In 1954 Pacific silver fir in southern Washington, especially on the Gifford Pinchot National Forest, was found to be seriously attacked by an insect tentatively identified as *Chermes piceae*, the balsam woolly aphid. A total of 129,920 acres was mapped as being infested by *Chermes* alone. An additional 146,240 acres was found to be infested by *Chermes* and silver fir beetles in combination. *C. piceae*, or a close relative, was observed to be killing alpine fir in the central Cascades of Oregon; however, the affected areas were too small and scattered to record from the air.

Chermes piceae has been attacking and killing grand fir in the Willamette Valley of Oregon since about 1930. Until 1954 it had not been reported on silver fir growing under forest conditions. This year a study of representative silver firs in southern Washington showed that *Chermes* had been present for many years. Infestation is most prevalent in overmature stands containing relatively large amounts of silver fir.

A series of sample plots was established on and adjacent to the Gifford Pinchot National Forest in 1954 to determine the course of the epidemic. Meanwhile, tree killing and weakening by *Chermes* has progressed to the point that plans for extensive salvage are being formulated and considerable salvage is under way. Experience with this insect in Eastern Canada indicates that direct control measures are impractical.

11. Spruce Aphid (*Neomyzaphis abietina*)

Spruce aphid infestation of Sitka spruce along the Oregon and Washington coast reached a peak in 1953 and declined in 1954. The recorded epidemic infestation in 1953 was 22,600 acres as compared with 4,480 acres in 1954. Practically all of this year's epidemic infestation was in the Willapa Bay area in Washington and was a twofold increase in acreage for that state. Infestation in Oregon was much reduced in 1954.

^{2/} Northwest Forest Pest Action Committee - Spruce budworm control plan for 1955 in Oregon and Washington. Multilithed report. November 1954.

12. Dying Hemlock

During the 1954 survey 75,200 acres in western Washington was recorded as having dying hemlock in abundance. Ground examination indicated that the killing is even more prevalent than shown by the aerial survey and that insects probably are not doing the killing. Since the cause is unknown at present, the dying hemlock is listed here so it will not be overlooked. A study is needed.

Lodgepole Pine Sawfly (Neodiprion sp.)

The lodgepole pine sawfly outbreak that covered 20,000 acres in 1952 and 69,700 acres in 1953 on the Willamette and Deschutes National Forests in Oregon has subsided without any appreciable tree killing. A few of the most seriously defoliated trees have succumbed to attacks by bark beetles, but no aggressive outbreak of the beetles has developed in the sawfly area. Cool weather and above normal rainfall favored tree growth in 1954; consequently most of the defoliated trees put on good needle growth and apparently will recover.

Ground examinations in 1954 showed light feeding by the sawfly rather generally in the affected area. However, feeding was too light to detect from the air, hence no epidemic infestation was recorded.

The decline of the sawfly outbreak is attributed to parasites, predators and other factors of natural control acting in combination with suspended development (diapause) of a large part of the sawfly population. In the fall of 1953 most of the sawflies remained in their cocoons in the soil rather than emerging and laying eggs as they normally do. The relatively few overwintering eggs produced the light brood of 1954. The larvae in the cocoons laid over; some emerged in the fall of 1954; some are still in the soil; and many succumbed to insect parasites, rodents, disease, and weather. As a result of this sequence of events the outbreak appears to be ended.

Bear Damage - The fact that bears are causing extensive damage to forests in Washington and Oregon is, at first, almost unbelievable. However, this damage is real and presents a serious problem to foresters in the management of stands already only partially stocked. The acreage of damage attributable to bears recorded during the regional aerial surveys since 1951 is as follows:

<u>Year of Survey</u>	<u>Acreage of Bear Damage</u>		<u>Total</u>
	<u>Oregon</u>	<u>Washington</u>	
1951	0	208,800	208,800
1952	2,560	36,160	38,720
1953	18,080	118,240	136,320
1954	97,750	194,560	292,310

The bears, by clawing the bark from trees cause them to die. The bark is eaten by the bears, as proven by the analysis of the stomachs from trapped and killed bears. The most severe damage in 1954 was in southwestern Washington and northwestern Oregon. The Bear Facts Committee of the Puget Sound Section of the Society of American Foresters is investigating this damage and no doubt has more data than shown here.

PART III - APPENDIX

Acknowledgments

Without the wholehearted cooperative efforts of many individuals and organizations, the 1954 forest insect survey project in Region 6 could not have been accomplished. It is hoped that the following acknowledgments are complete, for no oversight is intended.

The 1954 regional aerial survey was a cooperative project between the Oregon State Board of Forestry, the U.S.D.A. Agricultural Research Service, and the Pacific Northwest Forest and Range Experiment Station. Messrs. W. J. Buckhorn and P. W. Orr of the Station were observers and mappers during the aerial phase of the survey in Oregon and Washington. The Blue Mountain Area of the two states was covered in the Oregon State Board of Forestry Cessna 170, with Mr. A. T. Larsen, pilot for the State. The rest of Oregon was covered in a Cessna 170 rented by the Station, with Mr. J. Harrell employed as pilot for the period July 12-28, 1954. The coastal area of Washington was covered in the Station's Cessna 170, with Mr. J. F. Wear as pilot. The rest of Washington was surveyed in a Cessna 180, obtained from the U.S.D.A. Agricultural Research Service on a cost basis, with Mr. N. Meyer, of that agency as pilot. Several foresters of private companies conducted aerial surveys of their holdings, particularly Mr. P. Lauterbach of Weyerhaeuser Timber Company, and made their survey findings available to the Station.

The compilation of the region survey findings was done by Messrs. A. Gruba, A. Larsen, and D. Sheridan of the Oregon State Board of Forestry and Messrs. W. J. Buckhorn, W. K. Coulter, and K. H. Wright of the Station. The large-scale maps of the 1954 infestations were prepared by Messrs. Gruba and Buckhorn. Maps 1 and 2 in this report were prepared under the direction of Mrs. K. Flaherty of the Station.

The findings of the Silver Fir Beetle Subcommittee, under the Chairmanship of Mr. R. V. Dickhaus, is another example of cooperative effort. A total of 787 man days was spent on the project, with approximately 75 percent of the time spent on field work and 25 percent in meetings and office work, by 6 private, 3 State of Washington, and 2 federal agencies. A report by the Subcommittee has been prepared.

The rephotography of the Douglas-fir beetle plots was under the direction of Mr. J. F. Wear in the Station's Cessna 170 with Mr. W. C. Guy and Mr. B. G. Fleischman, Jr. employed as Photographers during the periods June 28 - August 27 and September 3-30, 1954 respectively. The analysis and interpretation of aerial photographs on this project was under the direction of Mr. R. B. Pope of the Station, with Prof. J. R. Dilworth of Oregon State College assisting with the interpretation under a three month cooperative agreement between the College and the Station. A summary of the work on this project has been issued.

The multilith plates for this report were prepared by Mrs. G. L. Lee, Mrs. W. L. Taylor, and Mr. J. Y. Braden. Part of the multilith reproduction was by Miss C. D. Tomlinson.

TABLE 3. SUMMARY OF 1954 COOPERATIVE FOREST INSECT AERIAL SURVEYS

Subregion and Agency	Survey Aircraft	Timbered Acres Surveyed	Air Miles Flown	Mapping Hours	Ferry Hours	Total Survey Hours
Western Oregon PFES & OSBF	Cessna 170	15,670,425	6,158	63.6	5.0	68.6
Eastern Oregon Cascades PFES	Cessna 170	6,590,480	3,300	32.0	1.0	33.0
Blue Mountains OSBF	Cessna 170	6,963,975	3,825	66.8	3.5	40.3
Eastern Wn., Cascades PFES & ARS	Cessna 180	7,147,809	2,935	24.2	2.5	26.7
Western Washington PFES & ARS	Cessna 180 Cessna 170	11,774,011	4,612	42.2	3.5	45.7
TOTALS FOR 1954 SURVEY		48,146,734	20,830	198.8	24.0*	222.8*
TOTALS FOR 1953 SURVEY		47,340,034	22,600	188.4	15.9	204.3
TOTALS FOR 1952 SURVEY		34,827,564	17,826	151.8	19.1	170.9
TOTALS FOR 1951 SURVEY		49,000,000	27,910	199.2	21.6	220.8
TOTALS FOR 1950 SURVEY		48,229,354	26,580	182.1	21.1	203.2
TOTALS FOR 1949 SURVEY		49,000,000	22,275	172.4	29.9	202.3

* Includes 8.5 hours of ferry time on plane from Aberdeen, S.D. to Portland, Oregon

ARS - USDA Agricultural Research Services
 OSBF - Oregon State Board of Forestry
 PFES - Pacific Northwest Forest and Range Experiment Station

TABLE 4. RESULTS OF 1954 COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN WASHINGTON

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
<u>WESTERN WASHINGTON</u>							
Clallam	Rayonier, Inc.	K.W. Brynestad D. Rotter Larsen	7/21-27	4	1	6	7
Clark	WSDF	E.W. Smith P.O. Neumann	7/13-14	4	0	5	5
Cowlitz	Weyerhaeuser Timber Co.	S.E. Blinks J. Palmquest G.W. Potter	7/1-7	6	1	11	12
	WSDF	R. Shero N. Ortwein E.W. Smith P.O. Neumann	7/12-22	3	0	5	5
	PNWFES	P.W. Orr A. Nunan	7/6	1	0	2	2
Grays Harbor	Clemons Tree Farm	W.J. Guenther	6/23	1	0	2	2
	So. Olympic Tree Farm	W.S. Looney Quinn	6/23-4	2	0	5	5
Jefferson	Crown Zellerbach Corp.	C.H. Willison F. Foldi	7/19	2	0	3	3
King	Weyerhaeuser Timber Co.	D.H. Dowling J.D. Kerlee	6/24-30	2	0	3	3
	WSDF	R.W. Junk	6/30-7/2	2	0	3	3
Lewis	Weyerhaeuser Timber Co.	M.T. Alexander S.E. Blinks G.W. Potter	7/28-29 7/6	2 1	0 1	5 0	5 1
	WSDF	J. Matthias Black G.T. McCray	6/28-30	3	0	6	6

Table 4. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
Lewis	PNWFES	P.W.Orr A.Nunan	7/7	1	0	2	2
Mason	So.Olympic Tree Farm	W.S.Looney Quinn	6/24-30	4	0	7	7
Pacific	Clemons Tree Farm	W.J.Guenther V.McCowan Wiksten	6/18	1	0	1	1
	Crown Zellerbach Corp.	W.H.Christy W.S.Hicks J.D.Prater	7/12 6/23	1 1	0 0	1 2	1 2
Pierce	WSDF	L.S.Vandercook J. Matthias Black G.T.McCray	7/10-14 6/28-29	1 3	0 0	2 7	2 7
Skagit	WSDF Weyerhaeuser Timber Co.	R. Benham Garey	7/16-19 7/30	2 1	0 0	6 4	6 4
Skamania	PNWFES	P.W.Orr A.Nunan	6/29-7/7	4	0	8	8
Snohomish	Weyerhaeuser Timber Co.	J.Gruenfeld Garey G.E.McAninch	7/28-29	4	0	12	12
Thurston	WSDF	D.J.Taylor	7/6-8	2	0	3	3
Wahkiakum	Crown Zellerbach Corp.	W.H.Christy W.S.Hicks J.D.Prater	6/23- 7/12	2	0	6	6
Whatcom	WSDF	S.R.Daniels	7/1	1	0	2	2
<u>Subtotal for Western Washington</u>							
16	7	36	6/23- 7/29	61	3	119	122

Table 4. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
<u>EASTERN WASHINGTON</u>							
Klickitat	PNWFES	P.W.Orr A. Nunan	6/30-7/1	4	3	2	5
	Longview Fiber Co.	J.Loeb	7/20	1	3	3	6
	PNWFES	P.W.Orr A.Nunan	7/18	2	5	4	9
<u>Subtotal for Eastern Washington</u>							
2	2	3	6/30-7/20	7	11	9	20
<u>TOTAL FOR WASHINGTON</u>							
18	9	39	6/23- 7/29	68	14	128	142

TABLE 5. RESULTS OF 1954 COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN OREGON

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
<u>WESTERN OREGON</u>							
Benton	OSBF	T. Popham	8/11-12	2	0	5	5
Clackamas	Crown Zellerbach Corp.	K.W. Clark J.P. Johnston	7/12	2	0	8	8
	Weyerhaeuser Timber Co.	S.E. Blinks J. Palmquest G.W. Potter	7/1	3	0	3	3
	Mt. Hood NF (PNWFES)	P.W. Orr A. Nunan	6/22-28	4	2	6	8
Clatsop	Crown Zellerbach Corp.	R.M. Mosar	7/14-16	2	0	7	7
Columbia	Crown Zellerbach Corp.	L. Pugsley	6/29-7/16	2	0	4	4
Coos	OSBF	T. Popham	8/24	1	0	2	2
	Bur. Land Management	R.J. Knepper J. Laush L.W. Morrison G.C. Smith	6/30-7/28	3	0	5	5
	Siskiyou NF	D.B. Stickney	7/14	.5	0	3	3
Curry	OSBF	T. Popham	8/24-26	3	0	12	12
	Siskiyou NF	W.E. Ragland	7/16	.5	0	1	1
Douglas	Weyerhaeuser Timber Co.	R.M. Gehrman	7/19	.5	0	1	1
	OSBF	T. Popham	8/18-31	6	4	13	17
	Rogue River NF	W.R. Robinson	7/9	.5	0	1	1
	Siskiyou NF	D.B. Stickney	7/14	.5	0	1	1
	Umpqua NF	G.W. Churchill	7/28	1	0	4	4

Table 5. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
Douglas	PNWFES	P.W.Orr A.Nunan	6/15	1	0	1	1
Jackson	Rogue River NF	W.R.Robinson	6/24-7/9	4	1	14	15
Josephine	OSBF	T.Popham	8/31-9/1	2	0	4	4
	Siskiyou NF	J.A.Matoon	7/3	1	0	2	2
		H.Ritter	7/14	.5	0	1	1
Lane	Giustina Bros. Lumber Co.	C.E.Rodgers	7/13	1	0	2	2
	Long Bell Lumber Company	C.L.Foster	6/14-17	2	0	5	5
	Weyerhaeuser Timber Co.	R.M.Gehrman	7/19	.5	0	1	1
	OSBF	T.Popham	8/13-18	3	2	8	10
	Willamette NF (PNWFES)	P.W.Orr A.Nunan	6/16-18	6	3	12	15
Lincoln	OSBF	T.Popham	8/12	1	0	3	3
Linn	Timber Service Co.	Penney Shaw	7/2-8	4	0	8	8
	OSBF	T.Popham	8/16	1	0	3	3
	Willamette NF (PNWFES)	P.W.Orr A.Nunan	6/18-21	2	2	5	7
Marion	OSBF	T.Popham	8/2-3	2	0	4	4
	Willamette NF (PNWFES)	P.W.Orr A.Nunan	6/21	2	1	4	5
Multnomah	Mt.Hood NF (PNWFES)	P.W.Orr A.Nunan	6/28	1	0	2	2
Polk	Willamette Valley Lbr. Co.	M.Bergman	7/14	1	0	5	5
	OSBF	T.Popham	7/27-8/11	2	0	3	3

ble 5. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	Number of Sample Plots		
					Budworm Present	Budworm Absent	Total Plots
Tillamook	Crown Zellerbach Corp. OSBF	M.A.Mosar T.Popham	6/21-25 7/27-29	1.5 2	0 0	3 5	3 5
Washington	OSBF	T.Popham	7/28	1	0	2	2
Yamhill	OSBF	T.Popham	7/27-28	1	0	4	4
	Bureau Land Management	D.Christman	6/29	1	0	2	2
<hr/>							
Subtotal for Western Oregon							
18	13	29	6/14-9/9	75	15	179	194
<hr/>							
<u>EASTERN OREGON</u>							
Deschutes	OSBF	T.Popham	9/3-8	2	0	6	6
Jefferson	OSBF	T.Popham	9/3-9	2	0	5	5
Klamath	OSBF	T. Popham	9/1-2	2	1	4	5
	Rogue River NF	W.R.Robinson	7/8-9	1	0	3	3
Wasco	Mt.Hood NF (PNWFES)	P.W.Orr A.Nunan	6/25	2	1	4	5
<hr/>							
Subtotal for Eastern Oregon							
4	3	4	6/25-9/9	9	2	22	24
<hr/>							
<u>TOTAL FOR OREGON</u>							
22	16	33	6/14-9/9	84	17	201	218
<hr/>							
<u>TOTAL FOR REGION 6</u>							
40	25	72	6/14-9/9	142	31	329	360
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TABLE 6. SUMMARY OF FOREST INSECT EPIDEMIC CENTERS OF INFESTATION
RECORDED DURING 1954 SURVEY

INSECT	WASHINGTON		:	OREGON		:	REGION 6 - TOTAL	
	Number of Centers	Acres		Number of Centers	Acres		Number of Centers	Acres
BARK BEETLES								
1. Douglas-Fir Beetle	298	631,210		738	4,440,540		1,036	5,071,750
2. Silver Fir Beetles	144	635,840		12	16,390		156	652,230
3. Western Pine Beetle	41	114,240		139	153,730		180	267,970
4. Mountain Pine Beetle	111	132,960		95	74,160		206	207,120
5. Fir Engraver Beetles	27	28,960		27	27,240		54	56,200
6. Pine Engraver Beetle	3	3,520		49	36,330		52	39,850
7. E. Spruce Beetle	9	12,480		3	6,240		12	18,720
Subtotal	633	1,559,210		1,063	4,754,630		1,696	6,313,840
DEFOLIATORS								
8. Spruce Budworm	1	28,400		14	1,006,040		15	1,034,440
9. Balsam-Woolly Aphid	9	129,920					9	129,920
11. Spruce Aphid	2	4,320		1	160		3	4,480
Subtotal	12	162,640		15	1,006,200		27	1,168,840
COMBINATION								
10. Balsam Woolly Aphid and Silver Fir Beetles	3	146,240					3	146,240
OTHER								
12. Unknown Dying Hemlock	29	75,200					29	75,200
GRAND TOTAL	677	1,943,290		1,078	5,760,830		1,755	7,704,120

TABLE 7. RECORD OF INSECT-CAUSED LOSSES ON FORESTED AREAS OF WASHINGTON
BY SPECIES AND INTENSITY OF DAMAGE - SEASON OF 1954

Forest Area	Insect	Number of Centers	Acreage of Infestations by Intensities				
			Light	Moderate	Heavy	Very Heavy	Total
Chelan N.F. and Adjacent Forest Land	Douglas-fir beetle	45	44,630	27,320	2,880	0	74,830
Gifford Pinchot N.F. and Adjacent Forest Land	Balsam Woolly aphid	9	37,280	45,440	38,080	9,120	129,920
	Douglas-fir beetle	48	74,700	96,800	65,760	0	237,260
	Fir engraver beetle	10	1,600	7,360	640	3,680	13,280
	Mountain pine beetle	28	4,160	11,200	17,920	3,680	36,960
	Silver fir beetles	1	0	2,080	0	0	2,080
	Silver fir beetles and Balsam Woolly aphid	3	16,480	82,880	36,640	10,240	146,240
	Western pine beetle	5	4,480	960	0	0	5,440
	Subtotal	104	138,700	246,720	159,040	26,720	571,180
Mt. Baker N.F. and Adjacent Forest Land	Douglas-fir beetle	5	1,120	0	8,320	0	9,440
	Mountain pine beetle	12	3,200	5,920	4,160	0	13,280
	Silver fir beetles	58	88,320	182,720	94,080	34,880	400,000
	Subtotal	75	92,640	188,640	106,560	34,880	422,720
Olympic N.F. and Adjacent Forest Land	Douglas-fir beetle	2	.800	1,760	0	0	2,560
	Mountain pine beetle	5	0	480	2,240	0	2,720
	Silver fir beetles	27	41,120	8,480	0	0	49,600
	Unknown hemlock	18	31,680	3,200	0	0	34,880
	Subtotal	52	73,600	13,920	2,240	0	89,760

Table 7. (Continued)

Forest Area	Insect	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Snoqualmie N.F. and Adjacent Forest Land	Douglas-fir beetle	26	12,320	8,000	0	0	20,320
	Engelmann spruce beetle	7	1,280	2,240	960	6,240	10,720
	Fir engraver beetle	1	0	1,120	0	0	1,120
	Mountain pine beetle	39	12,320	11,680	3,040	0	27,040
	Silver fir beetles	31	37,600	71,680	15,840	1,280	126,400
	Western pine beetle	6	6,720	0	0	0	6,720
	Subtotal	110	70,240	94,720	19,840	7,520	192,320
Wenatchee N.F. and Adjacent Forest Land	Douglas-fir beetle	62	27,200	35,840	3,840	0	66,880
	Engelmann spruce beetle	2	1,760	0	0	0	1,760
	Fir engraver beetle	9	2,720	6,880	0	0	9,600
	Mountain pine beetle	18	10,400	17,120	16,000	2,080	45,600
	Pine engraver beetle	3	800	2,400	320	0	3,520
	Silver fir beetles	3	1,280	2,080	0	0	3,360
	Western pine beetle	4	3,840	0	0	0	3,840
	Subtotal	101	48,000	64,320	20,160	2,080	134,560
Mt. Rainier National Park	Douglas-fir beetle	3	2,400	1,760	1,120	0	5,280
	Mountain pine beetle	3	0	640	1,600	0	2,240
	Silver fir beetles	2	1,760	0	0	0	1,760
	Subtotal	8	4,160	2,400	2,720	0	9,280
Olympic National Park	Douglas-fir beetle	2	1,920	0	0	0	1,920
	Mountain pine beetle	3	1,120	1,120	1,760	0	4,000
	Silver fir beetles	17	25,280	9,280	0	0	34,560
	Unknown hemlock	1	1,760	0	0	0	1,760
	Subtotal	23	30,080	10,400	1,760	0	42,240

Table 7. (Continued)

Forest Area	Insect	Number of Centers	Acreage of Infestations by Intensities				
			Light	Moderate	Heavy	Very Heavy	Total
Umatilla N.F. and Adjacent Forest Land	Douglas-fir beetle	54	9,920	19,520	31,300	20,160	80,900
	Spruce budworm	1	25,200	3,200	0	0	28,400
	Subtotal	55	35,120	22,720	31,300	20,160	109,300
Colville Indian Reservation	Douglas-fir beetle	41	23,500	55,520	29,280	5,120	113,420
	Mountain pine beetle	1	0	480	0	0	480
	Subtotal	42	23,500	56,000	29,280	5,120	113,900
-ot- Yakima Indian Reservation	Douglas-fir beetle	5	800	3,680	320	0	4,800
	Fir engraver beetle	7	1,920	3,040	0	0	4,960
	Mountain pine beetle	2	640	0	0	0	640
	Western pine beetle	20	64,800	19,680	10,880	0	95,360
	Subtotal	34	68,160	26,400	11,200	0	105,760
Klickitat County	Western pine beetle	5	2,560	0	0	0	2,560
Southwest Washington	Douglas-fir beetle	5	4,320	320	8,960	0	13,600
	Silver fir beetles	6	8,000	10,080	0	0	18,080
	Spruce aphid	2	0	0	4,320	0	4,320
	Unknown hemlock	10	32,960	5,600	0	0	38,560
	Subtotal	23	45,280	16,000	13,280	0	74,560

Table 7. (Continued)

Insect	Number of Centers	Light	Acreage of Infestations by Intensities			Total
			Moderate	Heavy	Very Heavy	
Balsam woolly aphid	9	37,280	45,440	38,080	9,120	129,920
Douglas-fir beetle	298	203,630	250,520	151,780	25,280	631,210
Engelmann spruce beetle	9	3,040	2,240	960	6,240	12,480
Fir engraver beetle	27	6,240	18,400	640	3,680	28,960
Mountain pine beetle	111	31,840	48,640	46,720	5,760	132,960
TOTAL BY INSECTS Pine engraver beetle	3	800	2,400	320	0	3,520
Silver fir beetles	114	203,360	286,400	109,920	36,160	635,840
Silver fir beetles and Balsam woolly aphid	3	16,480	82,880	36,640	10,240	146,240
Spruce budworm	1	25,200	3,200	0	0	28,400
Spruce aphid	2	0	0	4,320	0	4,320
Western pine beetle	41	82,720	20,640	10,880	0	114,240
Unknown hemlock	29	66,400	8,800	0	0	75,200
GRAND TOTAL FOR WASHINGTON	677	676,990	769,560	400,260	96,480	1,943,290

TABLE 8. RECORD OF INSECT-CAUSED LOSSES ON FORESTED AREAS OF OREGON BY SPECIES AND INTENSITY OF DAMAGE
SEASON OF 1954

Forest Area	Insect	Number of Centers	Acreage of Infestations by Intensities				
			Light	Moderate	Heavy	Very Heavy	Total
Deschutes N.F. and Adjacent Forest Land	Douglas-fir beetle	7	5,920	2,400	0	0	8,320
	Mountain pine beetle	21	8,000	3,720	5,100	8,480	25,300
	Western pine beetle	27	23,080	5,920	2,720	320	32,040
	Subtotal	55	37,000	12,040	7,820	8,800	65,660
Fremont N.F. and Adjacent Forest Land	Mountain pine beetle	10	5,780	1,420	640	0	7,840
	Western pine beetle	7	18,320	640	0	0	18,960
	Subtotal	17	24,100	2,060	640	0	26,800
Malheur N.F. and Adjacent Forest Land	Douglas-fir beetle	3	2,190	0	1,000	0	3,190
	Mountain pine beetle	7	0	1,240	3,360	0	4,600
	Pine Engraver beetle	2	980	0	0	0	980
	Spruce budworm	3	58,500	60,490	105,080	23,300	247,370
	Western pine beetle	40	33,550	4,640	0	0	38,190
	Subtotal	55	95,220	66,370	109,440	23,300	294,330
Mt. Hood N.F. and Adjacent Forest Land	Douglas-fir beetle	49	60,420	66,630	42,240	12,180	181,470
	Fir engraver beetle	4	640	0	320	0	960
	Mountain pine beetle	19	4,000	4,200	2,600	0	10,800
	Silver fir beetles	3	0	3,680	0	0	3,680
	Western pine beetle	2	1,920	0	0	0	1,920
	Subtotal	77	66,980	74,510	45,160	12,180	198,830
Ochoco N.F. and Adjacent Forest Land	Douglas-fir beetle	1	360	0	0	0	360
	Mountain pine beetle	2	480	0	160	0	640
	Spruce budworm	1	125,670	96,450	9,260	0	231,380
	Western pine beetle	34	33,980	0	0	0	33,980
	Subtotal	38	160,490	96,450	9,420	0	266,360

Table 8. (Continued)

Forest Area	Insect	Number of Centers	Light	Acreage of Infestations by Intensities			
				Moderate	Heavy	Very Heavy	Total
Rogue River N.F. and Adjacent Forest Land	Douglas-fir beetle	62	162,890	2,940	8,040	0	173,870
	Fir engraver beetle	1	160	0	0	0	160
	Mountain pine beetle	10	300	0	1,120	1,920	3,340
	Pine engraver beetle	1	0	0	160	0	160
	Western pine beetle	11	9,320	960	0	0	10,280
	Subtotal	85	172,670	3,900	9,320	1,920	187,810
Siskiyou N.F. and Adjacent Forest Land	Douglas-fir beetle	103	124,280	137,020	15,320	0	276,620
Siuslaw N.F. and Adjacent Forest Land	Douglas-fir beetle	154	324,500	384,320	275,620	62,250	1,046,690
	Fir engraver beetle	1	180	0	0	0	180
	Silver fir beetles	2	1,920	750	0	0	2,670
	Subtotal	157	326,600	385,070	275,620	62,250	1,049,540
Umatilla N.F. and Adjacent Forest Land	Douglas-fir beetle	114	77,090	104,120	109,340	23,240	313,790
	Engelmann spruce beetle	3	480	3,680	2,080	0	6,240
	Fir engraver beetle	5	0	10,560	0	3,200	13,760
	Mountain pine beetle	2	0	320	240	0	560
	Pine engraver beetle	13	0	1,000	1,280	600	2,880
	Spruce budworm	1	5,320	9,230	0	0	14,550
	Subtotal	138	82,890	128,910	112,940	27,040	351,780
Umpqua N.F. and Adjacent Forest Land	Douglas-fir beetle	56	357,630	520,160	236,480	25,660	1,139,930
	Mountain pine beetle	1	960	0	0	0	960
	Subtotal	57	358,590	520,160	236,480	25,660	1,140,890
Wallowa-Whitman N.F. and Adjacent Forest Land	Douglas-fir beetle	68	13,120	37,720	4,320	160	55,320
	Fir engraver beetle	5	1,280	1,280	1,280	0	3,840
	Mountain pine beetle	5	160	640	800	0	1,600
	Pine engraver beetle	31	4,960	5,660	19,200	1,400	31,220
	Spruce budworm	9	221,260	183,360	99,880	8,240	512,740
	Western pine beetle	9	5,920	0	160	0	6,080
	Subtotal	127	246,700	228,660	125,640	9,800	610,800

Table 8. (Continued)

Forest Area	Insect	Number of Centers	Acreage of Infestations by Intensities				
			Light	Moderate	Heavy	Very Heavy	Total
Willamette N.F. and Adjacent Forest Land	Douglas-fir beetle	67	250,140	326,000	148,560	16,500	741,200
	Fir engraver beetle	7	1,600	480	0	4,120	6,200
	Mountain pine beetle	3	0	0	760	0	760
	Silver fir beetles	7	0	8,760	1,280	0	10,040
	Subtotal	84	251,740	335,240	150,600	20,620	758,200
Crater Lake N.P.	Douglas-fir beetle	1	400	0	0	0	400
	Fir engraver beetle	1	320	0	0	0	320
	Subtotal	2	720	0	0	0	720
Klamath Ind. Res.	Fir engraver beetle	1	0	4,480	4,680	0	9,160
	Mountain pine beetle	15	13,600	2,880	1,280	0	17,760
	Western pine beetle	2	2,560	0	0	0	2,560
	Subtotal	18	16,160	7,360	5,960	0	29,480
Warm Springs Ind. Res.	Douglas-fir beetle	9	4,160	19,520	0	0	23,680
	Pine engraver beetle	1	0	0	640	0	640
	Western pine beetle	4	7,200	2,080	0	0	9,280
	Subtotal	14	11,360	21,600	640	0	33,600
Central Oregon Area	Douglas-fir beetle	7	1,910	1,380	0	0	3,290
	Fir engraver beetle	2	820	0	0	0	820
	Pine engraver beetle	1	0	0	450	0	450
	Western pine beetle	3	160	280	0	0	440
	Subtotal	13	2,890	1,660	450	0	5,000
Coos Bay Area	Douglas-fir beetle	35	124,280	164,990	138,540	43,960	471,770
Northwest Oregon Area	Douglas-fir beetle	2	160	480	0	0	640
	Spruce aphid	1	0	0	160	0	160
	Subtotal	3	160	480	160	0	800

Table 8. (Continued)

Insect	Number of Centers	Acreage of Infestations by Intensities				
		Light	Moderate	Heavy	Very Heavy	Total
Douglas-fir beetle	738	1,509,450	1,764,160	982,980	183,950	4,440,540
Engelmann spruce beetle	3	480	3,680	2,080	0	6,240
Fir engraver beetle	27	5,000	12,320	2,600	7,320	27,240
Mountain pine beetle	95	33,280	14,420	16,060	10,400	74,160
Pine engraver beetle	49	5,940	6,660	21,730	2,000	36,330
Silver fir beetles	12	1,920	13,190	1,280	0	16,390
Spruce aphid	1	0	0	160	0	160
Spruce budworm	14	410,750	349,530	214,220	31,540	1,006,040
Western pine beetle	139	136,010	14,520	2,880	320	153,730
TOTAL BY INSECTS						
GRAND TOTAL FOR OREGON	1,078	2,102,830	2,178,480	1,243,990	235,530	5,760,830

LIST OF SPRUCE BUDWORM REPORTS AND PUBLICATIONS

- Anonymous. Spectacular Spraying Project. West Coast Lumberman 76 (7): 59-60, 125, illus. 1949.
- Brockman, C. F. War on the Budworm. American Forests 56 (9): 22-3, 43-5, illus. 1950.
- Brockman, C. F. and D. Berry. The Chesnimus Experimental Spruce Budworm Control Project. Oregon State Board of Forestry Research Bulletin No. 5. December 31, 1950.
- Brown, R. C. The Spruce Budworm. U.S.D.A. Leaflet No. 242. 1944
- Buckhorn, W. J. Defoliator Situation in the Fir Stands of Eastern Oregon and Washington, Season of 1947. Forest Insect Laboratory Report, February 18, 1948.
- Buckhorn, W. J. and Dick W. Berry. The La Grande Experimental Spruce Budworm Control Project, Season of 1951. Mimeographed Report, February 1, 1953.
- Carolyn, V. M., Jr. Studies of the Biological Control of the Spruce Budworm in Oregon - 1950. Special Report, New Haven Forest Insect Laboratory, November 20, 1950.
- Carolyn, V. M., Jr. and K. H. Wright. Studies of the Biology and Control of the Spruce Budworm in Oregon and Washington, Season of 1951. Mimeographed Report, April 1, 1953.
- Coulter, W. K. Studies of the Biology and Control of the Spruce Budworm in Oregon and Washington, Season of 1952. Mimeographed Report, April 1, 1953.
- Eaton, C. B., J. A. Beal, R. L. Furniss, and C. F. Speers. Airplane and Helicopter Spraying with DDT for Spruce Budworm Control. Journal of Forestry 47 (10): 823-7. 1949.
- Furniss, R. L., W. J. Buckhorn and K. H. Wright. The Spruce Budworm in Oregon and Washington, Season of 1948. Forest Insect Laboratory Report, November 1, 1948.
- Furniss, R. L. Statement on Spruce Budworm Mortality Obtained on 1951 Control Project. Forest Insect Laboratory Report, August 10, 1951.
- Lindsten, A., W. J. Buckhorn, J. F. Wear, J. M. Whiteside, and K. H. Wright. Spruce Budworm Situation in Oregon and Washington, Season of 1949. Mimeographed Report, September 1, 1949.

Lindsten, A. and K. H. Wright. Report on the 1949 Western Oregon Spruce Budworm Control Project. Multilithed Report, March 30, 1951.

Northwest Forest Pest Action Committee

Spruce Budworm Control Plan for 1952 in Oregon and Washington
Multilithed Report, February 14, 1952.

Spruce Budworm Control Plan for 1953 in Oregon and Washington
Mimeographed Report, February, 1953.

Spruce Budworm Control Plan for 1954 in Oregon and Washington.
Mimeographed Report, November, 1953.

Olson, H. Fighting the Spruce Budworm by Air Attack. Nature Magazine
44 (4): 182-4, 194, illus. 1949.

Oregon State Board of Forestry and Bureau of Entomology and Plant Quar.
Report of Forest Insect Detection Surveys in Oregon and Washington,
Season of 1950. Multilithed Report, September 30, 1950.

Report of Forest Insect Detection Surveys in Oregon and Washington,
Season of 1951. Multilithed Report, November 15, 1951.

Report of Forest Insect Surveys in Oregon and Washington, Season of
1952. Multilithed Report, October 24, 1952.

Report of Forest Insect Surveys in Oregon and Washington, Season of
1953. Mimeographed Report, October 30, 1953.

Oregon State Board of Forestry.

1950 Spruce Budworm Control Project. Mimeographed Report, March 1951.

1951 Spruce Budworm Control Project. Mimeographed Report, Jan. 1952.

1952 Spruce Budworm Control Project. Mimeographed Report, Jan. 1954.

1953 Spruce Budworm Control Project. Mimeographed Report, Jan. 1954.

Spruce Budworm Action Committee.

Plan for Control of the Spruce Budworm in Oregon - 1949. Mimeographed
Report, November 12, 1948.

Spruce Budworm Control Plan for 1950 in Oregon and Washington
Multilithed Report, October 1, 1949.

Spruce Budworm Control Plan for 1951 in Oregon and Washington
Multilithed Report, October 27, 1950.

Whiteside, J. M. Results of Four Years Large Scale Spraying for the Spruce
Budworm on the Pacific Coast. Annual Report of the Maritime Section
of the Canadian Institute of Forestry. November, 1952.

Results of the 1950 Spruce Budworm Control Project in Oregon and Washing-
ton. Mimeographed table. August 1, 1950.

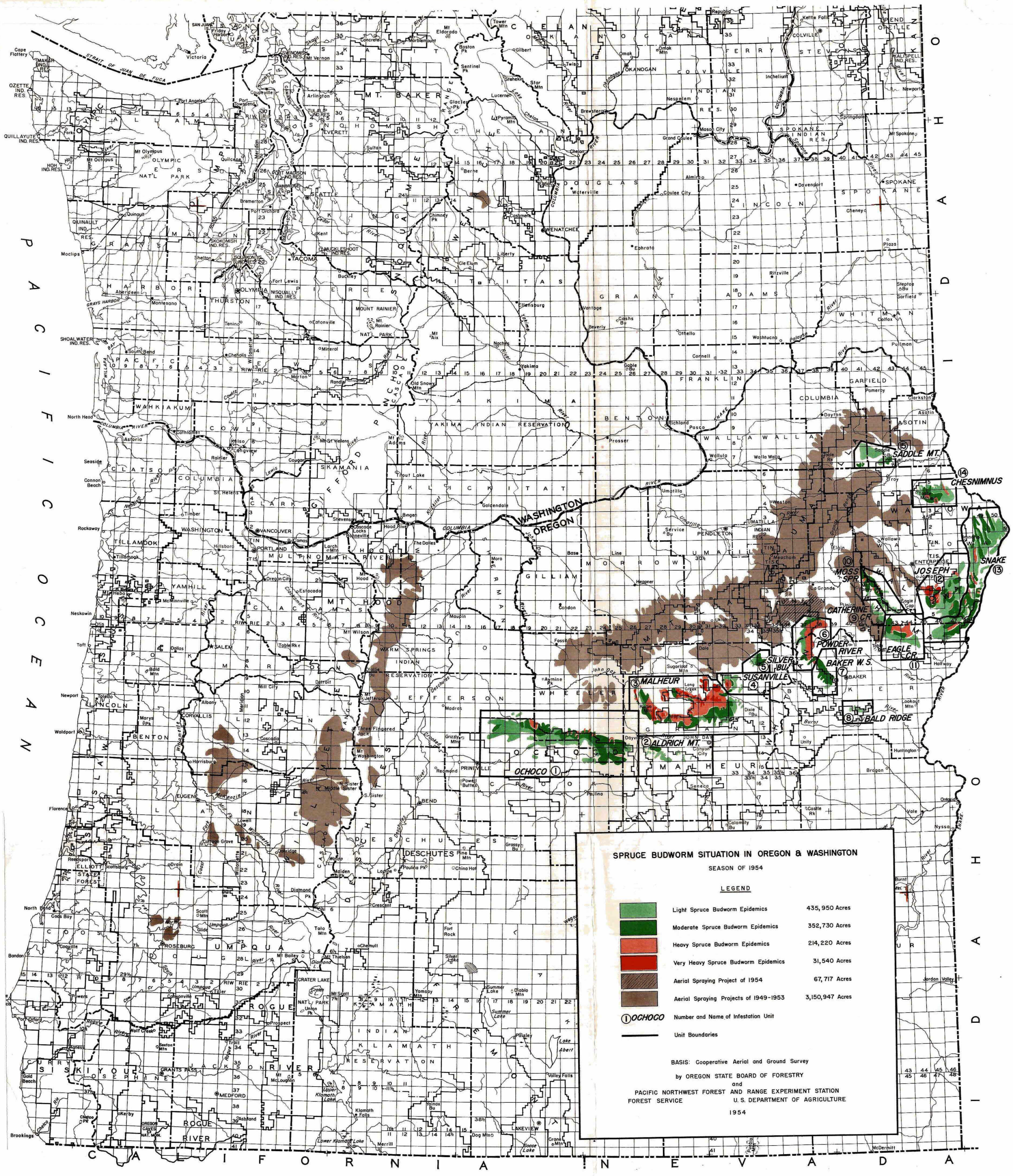
Statement on Spruce Budworm Mortality obtained During the 1952 Oregon -
Washington Spruce Budworm Control Project. Mimeographed Report,
August 1, 1952.

Whiteside, J. M.

Statement on Spruce Budworm Mortality Obtained During the 1953 Oregon Spruce Budworm Control Project. Mimeographed Report, August 20, 1953.

Results of the 1954 Oregon Spruce Budworm Control Project. Multilithed Report, October 1, 1954.

Wright, K. H., A. Lindsten, and R. E. Stevens. Results of Experiments to Improve Techniques for Sampling Overwintering Spruce Budworm Populations in Oregon and Washington, Progress Report 1. Mimeographed Report, May 20, 1952.



SPRUCE BUDWORM SITUATION IN OREGON & WASHINGTON

SEASON OF 1954

LEGEND

	Light Spruce Budworm Epidemics	435,950 Acres
	Moderate Spruce Budworm Epidemics	352,730 Acres
	Heavy Spruce Budworm Epidemics	214,220 Acres
	Very Heavy Spruce Budworm Epidemics	31,540 Acres
	Aerial Spraying Project of 1954	67,717 Acres
	Aerial Spraying Projects of 1949-1953	3,150,947 Acres
	Number and Name of Infestation Unit	
	Unit Boundaries	

BASIS: Cooperative Aerial and Ground Survey

by OREGON STATE BOARD OF FORESTRY
and
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

1954

